Assessing Validity of the Industry Standard for Flexibility

An Honors Thesis (HONR 499)

by

Michaela Hull

Thesis Advisor

Mary Winfrey-Kovell

Signed

Ball State University
Muncie, Indiana

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Expected Date of Graduation

May 2016

Abstract:

The purpose of this study was to compare the American College of Sports Medicine (ACSM) sit-and-reach, the industry standard measurement for flexibility, with the Grey Cook Functional Movement Screen (FMS) to determine if a better method for flexibility assessment could be determined. The sit-and-reach and FMS were evaluated on 30 students at Ball State University, age 18-25, and compared to one another. No significant difference ($p > 0.05$) was found between the two assessments. Differences between the right and left leg were found in the FMS, but no significant data was recorded. The number of participants limited the data sets in this study. In conclusion, there is no substantial evidence dictating that the FMS would be a better predictor of flexibility in young adults than the sit-and-reach assessment. However, the FMS may assist the sit-and-reach in assessing a subject's risk for lower back pain or provide a viable alternative.

Acknowledgements

I would like to thank Mary Winfrey-Kovell for advising me through this project. She gave willingly of her time, knowledge, and resources throughout every step of development.

I would also like to thank Kianre Eouanzoui and Sarah Shore-Beck for helping in the completion of this project.

INTRODUCTION:

Lifelong health benefits are associated with physical activity (Physical Education for Lifelong Fitness, 2005). The United States has seen an increase of individuals categorized as obese over the last decade. Escalation of the obesity epidemic has made the wellbeing of future generations a high priority. Physical education classes, clinical exercise physiologists, and fitness professionals all over the nation have implemented physical fitness assessments in order to classify identified individuals against other individuals the same age (Baumgartnar & Jackson, 1995; Bishop, 2008; Lacy, 2015; Tritschler; 2000; Physical Education for Lifelong Fitness, 2005) in order to assess physical fitness levels and CVD risk stratification.

These assessments allow fitness professionals to create exercise prescriptions to improve fitness and reduce health risk factors in clients. Tests implemented examine muscular strength and endurance, cardiorespiratory endurance, flexibility, and body composition. Each test is specialized to look at a different risk factor (ACSM's Guidelines for Exercise Testing and Prescription, 2014; ACSM's Health Related Physical Fitness Assessment Manual, 2014; Baumgartnar & Jackson, 1995; Bishop, 2008; Lacy, 2015; Tritschler; 2000; Physical Education for Lifelong Fitness, 2005).

Physical educators, clinical exercise physiologists, and fitness professionals are taught to assess flexibility with a variety of tests. The primary assessment used is the sit-and-reach (Baumgartnar & Jackson, 1995; Bishop, 2008; Lacy, 2015; Tritschler; 2000; Physical Education for Lifelong Fitness, 2005). Studies have been done to prove that sit and reach results have a direct correlation with hip and lower back flexibility (Lemmink, Kemper, de Greef, Rispens, &Stephens, 2003; Simoneau, 1998). The goal of physical

assessments is to address problem areas that may cause future harm to the individual. Lower back pain is one of the most common health concerns in adults (Rubin 2007, Freburger 2008, van Tulder 2002). Between 70%-90% of adults experience low back pain sometime throughout their lives (Rubin, 2007), and 90% of reported low back pain is non-specific and has no known origin (van Tulder, 2002). However, the American College of Sports Medicine indicates that hip and lower back flexibility may be related to the development of muscular low back pain, but cannot be proven (ACSM's Guidelines for Exercise Testing and Prescription, 2014).

Functional Movement Screening (FMS) was created with the intention of observing and documenting movement-patterns in healthy individuals (Cook, 2010). Human biomechanics are a series of chain reactions with cause and effect responses. No one part of the human body can be completely isolated from another. Every intended movement made by a person stimulates a subtle adjustment in the physical and mental state of the person to perform that initial request (Cook, 2010). Subtle degradation of movement patterns may predict increased risk for injury during physical activity (Cook, 2010). This screening involves dynamic movement and has been found to have good inter-rater reliability (Chimera, 2016).

First this study will analyze, the sit and reach test as the industry standard for flexibility. Finally, it will assess the correlation of the sit and reach with the FMS and lastly, it hopes to suggest that the FMS be adopted into general physical fitness assessments.

METHODS:

Subjects: Nine males and twenty-one females, for a total of thirty subjects, completed the sit and reach and FMS. The mean age of the male participants was 20.7 ± 1.6 years old and 20.9 ± 1.2 years for female participants. Informed consent and media consent forms were obtained from each participant prior to his or her participation in the study. Each participant completed the PAR-Q and Health History Questionnaire (HHQ). Based on their responses, all subjects were healthy with no contraindications for exercise testing. Each participant was free of any current lower extremity orthopedic diagnosis. Subjects ranged from active (exercising three or more days a week for 30 minutes) to inactive (exercising less than three days a week for 30 minutes). Approval was gained by the Institutional Review Board in preparation for human research in Ball States Human Performance Laboratory.

Procedures: The individual removed excess clothing and personal belongings so that movement would not be restricted.

ACSM Sit-and-Reach Assessment- Each subject sat without shoes on with the soles of his feet flat against the sit-and-reach box at the 23cm mark. The ACSM requires a 26cm box so 3 centimeters were subtracted from each value in the ACSM fitness category table. The subject was instructed to keep one hand on top of the other and keep both knees extended with the backs of his knees touching the floor while performing this assessment. It was conveyed to subjects that breathing out would maximize results. Three attempts were given to each participant and the furthest point reached with fingertips was recorded in centimeters. Each attempt was documented and the average of the farthest two were recorded as the final score.

Each subject was compared to fitness categories by age and sex given in the ACSM Guidelines for Exercise Testing and Prescription; Table 4.16. The five categories were each given a numerical value: Excellent (5), Very Good (4), Good (3), Fair (2), Needs Improvement (1).

Functional Movement Screening- Subjects then completed four of the seven FMS assessment tests. A standardized FMS kit comprised of a 4 ft, 2x6" board, a 4 ft bar, and two 3 ft bars with bungee cord was utilized to perform the FMS assessment. The Deep Squat, Hurdle Step, In-line Lunge, and Active Straight-Leg Raise were all scored on a 1 to 3 scale according to Dr. Grey Cook's descriptive publication. Scores were given based on the movement pattern of the subject. A score of 3 denoted completion of the proper movement. Completing the movement pattern with modification or compensation resulted in a score of 2. A score of 1 indicated that the subject was not able to complete the movement pattern. Finally, a 0 was given if the subject, while trying to complete the dynamic movement indicated pain.

Deep squat- Subjects stood with feet shoulder width apart and toes facing directly forward. The client was instructed to place the 4 ft. bar directly overhead, resting it on his head to make 90-degree angles with his elbows. Each subject was then told to press the bar directly overhead and to keep hands and arms in place. The participant was then instructed to squat as low as he could while keeping his heels on the floor, as illustrated in *Figure 1*. If the subject could not complete the deep squat correctly the client was then asked to place his or her heels on the FMS board as a modification. This modification was performed regardless if he successfully completed the deep squat without needing the modification. This method was chosen to assure video evidence of correct scoring.

Three trails were performed. A score was given to the subject on a 1 to 3 scale based on the movement pattern.

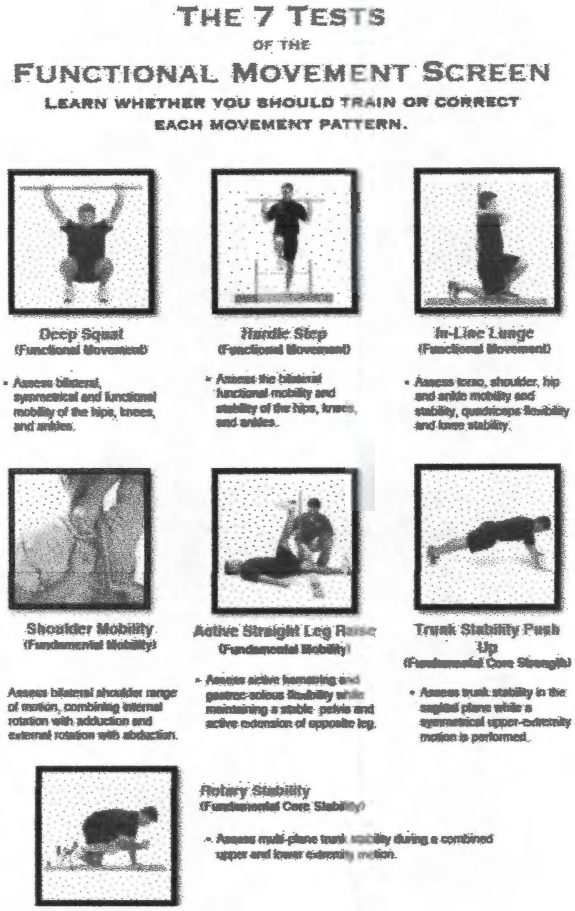

Figure 1: Illustrated FMS testing.

Hurdle Step –The subject was instructed to stand sideways next to the FMS hurdle and the height of his tibial tuberosity was measured. The FMS hurdle bungee cord was placed at the height of the individual's tibia tuberosity. The individual was instructed to stand directly behind the center of the hurdle base with his feet touching the board. The subject held the FMS bar behind the head, resting the bar on the upper trapezius. Each participant was instructed to step over the hurdle bungee cord to touch the heel of step leg

to the ground in front of the hurdle and return to the start position, as shown in *Figure 1*. This was then repeated on the opposite leg. Three trials were completed on each leg. A score was given to the subject on a 1 to 3 scale based on his movement pattern.

In-line Lunge- The third test involved the subject standing on the FMS 4ft, 2x6" board with one foot in front of the other. Standing with feet positioned one in front of the other; it was to be the same distance apart as the distance between the floor and the participant's tibial tuberosity. The tibial measurement was used from the previous assessment of the hurdle step. The subject then completed the lunge while holding the FMS bar behind his back, vertical to the spine. Subjects were instructed to hold the FMS bar with one hand behind the lower back and the other hand near the back of the neck. This ensured that the bar was vertical and directly along the spine. The subject was instructed to keep his head, t-spine, and sacrum against the bar at all times. The subject was then instructed to touch his back knee to the board directly behind the front foot, as illustrated in *Figure 1*, and return to standing position. This was repeated again with the opposite leg in front. Three trials were completed on each leg. A score was given to the subject on a 1 to 3 scale based on the movement pattern.

Active Straight-Leg Raise- The final assessment required the subject to lie in a supine position with his arms at his sides, palms facing upward. The FMS kit board was placed under the subject's knees. The subject was instructed to place both feet together in dorsiflexion before performing the leg raise. The FMS bar was placed to the side of the subject between the ASIS and the knee joint. The subject was then instructed to raise one leg as high as he could by flexing at the hip, while the non-moving leg remained extended with the heel touching the ground, as shown in *Figure 1*. The knees of both legs

were to remain extended during the movement. He was then asked to repeat this exact procedure with the opposite leg. Three trials were completed on each leg. A score of 1 to 3 was given to the subject based on his movement pattern.

Video analysis- The FMS was recorded on video and was reanalyzed to ensure accurate scoring.

Statistics- Subjects were primarily classified by sex and age. Activity level was also a factor used to determine the subject's level of physical fitness. Sit-and-reach classification categories were dependent upon the male or female population. Sit-and-reach data was compared to each of the FMS tests individually using IBM SPSS Statistics version 23. Each FMS test, which had a unilateral component, was also compared within itself using the SPSS program. Data are presented in the form of M± SD. Independent t-Tests were performed to make comparisons between groups. Statistical significance was established if $p < 0.05$.

RESULTS:

Differences between FMS tests of deep squat ($p= 0.237$), hurdle step ($p= 0.637$), inline lunge ($p= 0.090$), and straight leg raise ($p= 0.687$) with the sit-and-reach were not significant. Comparison between the right and left leg of bilateral testing was also not significant ($p>0.05$).

Table 1: Mean values of male and female data collection.

Test	Male	Female
Sit-and-reach	30.29 ± 7.31	38.22 ± 5.92
Deep squat	2.00 ± 0.47	2.14 ± 0.71
Hurdle step (left)	2.22 ± 0.63	2.19 ± 0.66
Hurdle step (right)	2.33 ± 0.67	2.14 ± 0.71
In-line lunge (left)	2.89 ± 0.31	2.67 ± 0.47
In-line lunge (right)	2.78 ± 0.42	2.48 ± 0.66
Active Straight leg raise (left)	2.89 ± 0.31	2.86 ± 0.35
Active Straight leg raise (left)	2.67 ± 0.47	2.95 ± 0.21

Table 2: Sit-and-reach compared to deep squat

Test Statistics[a,b]

	FMS-deep squat
Chi-Square	5.646
df	4
Asymp. Sig.	.227
Exact Sig.	.237
Point Probability	.002

a. Kruskal Wallis Test
b. Grouping Variable: S+R classification

Table 3: Sit-and-reach compared with overall hurdle step, inline lunge, and straight leg raise.

Test Statistics[a]

	FMS-hurdle step R - FMS-hurdle step L	FMS-inline lunge R - FMS-inline lunge L	FMS-straight leg raise R - FMS-straight leg raise L
Z	.000[b]	-1.667[c]	.000[b]
Asymp. Sig. (2-tailed)	1.000	.096	1.000
Exact Sig. (2-tailed)	1.000	.180	1.000
Exact Sig. (1-tailed)	.637	.090	.687
Point Probability	.273	.070	.375

a. Wilcoxon Signed Ranks Test

b. The sum of negative ranks equals the sum of positive ranks.

c. Based on positive ranks.

Table 4: Sit-and-reach compared with the left leg during testing.

Test Statistics[a,b]

	FMS-hurdle step L	FMS-inline lunge L	FMS-straight leg raise L
Chi-Square	1.779	1.635	4.711
df	4	4	4
Asymp. Sig.	.776	.802	.318
Exact Sig.	.794	.903	.251
Point Probability	.006	.110	.011

a. Kruskal Wallis Test

b. Grouping Variable: S+R classification

Table 5: Sit-and-reach compared with the right leg during testing.

Test Statistics[a,b]

	FMS-hurdle step R	FMS-inline lunge R	FMS-straight leg raise R
Chi-Square	2.759	1.301	6.264
df	4	4	4
Asymp. Sig.	.599	.861	.180
Exact Sig.	.644	.916	.147
Point Probability	.005	.022	.014

a. Kruskal Wallis Test
b. Grouping Variable: S+R classification

Table 6: Right and left legs compared with each other during unilateral tests.

Ranks

		N	Mean Rank	Sum of Ranks
FMS-hurdle step R - FMS-hurdle step L	Negative Ranks	4[a]	4.50	18.00
	Positive Ranks	4[b]	4.50	18.00
	Ties	22[c]		
	Total	30		
FMS-inline lunge R - FMS-inline lunge L	Negative Ranks	7[d]	5.00	35.00
	Positive Ranks	2[e]	5.00	10.00
	Ties	21[f]		
	Total	30		
FMS-straight leg raise R - FMS-straight leg raise L	Negative Ranks	2[g]	2.50	5.00
	Positive Ranks	2[h]	2.50	5.00
	Ties	26[i]		
	Total	30		

a. FMS-hurdle step R < FMS-hurdle step L
b. FMS-hurdle step R > FMS-hurdle step L
c. FMS-hurdle step R = FMS-hurdle step L
d. FMS-inline lunge R < FMS-inline lunge L
e. FMS-inline lunge R > FMS-inline lunge L
f. FMS-inline lunge R = FMS-inline lunge L
g. FMS-straight leg raise R < FMS-straight leg raise L
h. FMS-straight leg raise R > FMS-straight leg raise L
i. FMS-straight leg raise R = FMS-straight leg raise L

DISCUSSION:

The present study compared the sit-and-reach test with the FMS and current norms provided by the ACSM. It was hypothesized that men would have lower flexibility than women. When taking into consideration activity levels, it was predicted that active subjects would have higher levels of flexibility than inactive subjects. Class identification for each subject was established using ACSM standards of physical activity. Ultimately, it was believed that the sit-and-reach would not be a good predictor of an individual's overall flexibility levels. The FMS was included to supplement the study and offered as a replacement for the current industry standard. Nine males and twenty-one females completed the sit-and-reach and FMS exercise tests. Results of male and female sit-and-reach values were found to be congruent with predicted outcomes. The hypothesis was not supported by the sit-and-reach and FMS correlation, where no significant difference was found.

Sit-and-reach testing is the industry standard for flexibility. Test procedure varies depending on the type of assessment and equipment available to the professional administering the test. Canadian Trunk Forward Flexion test, YMCA sit-and-reach test, and goniometers are all options to assess the subject's flexibility with minimal equipment. The measurements of hip mobility

have been found to directly correlate with hamstring and low back flexibility. Only vague correlations have been made between lower back pain and flexibility, but no specific data has proven this theory (ACSM guidelines, 2014).

Increase lower back pain has been found to be the second most common cause of disability in US adults and a common reason for lost workdays. An estimated 149 million days of work per year are lost because of lower back pain (Freburger, 2008). The condition is also costly, with total costs estimated to be between $100 and $200 billion annually, two-thirds of which are due to decreased wages and productivity (Freburger, 2008). Movement screening tools can be used to predict non-contact injury risk and to guide injury prevention programs (Chimera, 2016).

The FMS measures the fundamental movements used in athletic performance and is made up of seven individual movement patterns. Of the seven movement patterns assessed, the deep squat, hurdle step, and inline lunge are considered the "big three," while the shoulder mobility, rotational stability, straight leg raise, and truck stability push up are referred to as the "little four" (Chimera, 2016). Four tests were used in this study: deep squat, hurdle step, inline lunge, and straight leg raise. These were chosen because of their focus on hip mobility and direct correlation with the sit-and-reach. In addition, the hurdle step, inline lunge, and straight leg raise allow evaluation of asymmetrical movements. Although no significance was found between right and left leg testing, asymmetry was still documented.

Grey Cook states that reduced mobility can be correlated with tightness of the hip flexors and hamstrings. As noted earlier, those factors are associated with chronic low back pain. Hip tightness is also assumed to cause back problems; however, the same could be assumed for back problems creating hip tightness. The FMS was founded with two rules, first that "pain changes everything," and secondly that "mobility must precede stability" (Cook, 2008). The FMS

provides more information on body dysfunction, which the sit-and-reach cannot, to provide intervention exercise prescriptions to prevent future problems. FMS is also a viable option when an individual cannot perform seated trunk flexion due to a diagnosed physical restriction or acute/chronic back pain. Everyone is born with uncompromised mobility, but over time people learn bad movement patterns. Introducing these fundamental movements in the physical education system at an early age may decrease negative movement patterns as an adult.

The number of subjects obtained limited this study. No significant difference could be evaluated in the active versus inactive population, because of low numbers of men and women participating in each category. More data is also needed to assess how youth and adolescent subjects, as well as non-athletes, react to the FMS. It would be interesting to perform a longitudinal study to assess when asymmetries begin to arise during a life span, or if continual mastery of movement screenings would decrease bilateral differences and chronic low back pain. The FMS provides a viable alternative for healthy young adults and individuals that cannot perform seated trunk flexion. It also provides more information on dysfunctional body movements than the sit-and reach. Although the FMS was not shown to be significantly better at predicting hamstring and low back flexibility, it was shown to be statistically equivalent to the industry standard.

BALL STATE UNIVERSITY

Office of Research Integrity
Institutional Review Board (IRB)
2000 University Avenue
Muncie, IN 47306-0155
Phone: 765-285-5070

DATE:	March 21, 2016
TO:	Michaela Hull
FROM:	Ball State University IRB
RE:	IRB protocol # 867778-2
TITLE:	Assessing Validity of the Industry Standard for Flexibility
SUBMISSION TYPE:	Revision
ACTION:	APPROVED
DECISION DATE:	March 21, 2016
EXPIRATION DATE:	March 20, 2018
REVIEW TYPE:	**Expedited:** This protocol had been determined by the board to meet the definition of minimal risk.

The Institutional Review Board has approved your Revision for the above protocol, effective March 21, 2016 through March 20, 2018. All research under this protocol must be conducted in accordance with the approved submission and in accordance with the principles of the Belmont Report.

Review Type:

	Category 1: Clinical studies of drugs and medical devices
	Category 2: Collection of blood samples by Finger stick, Heel stick, Ear stick, or *Venipuncture*
	Category 3: Prospective collection of biological specimens for research purposes by noninvasive means
	Category 4: Collection of data through Non-Invasive Procedures Routinely Employed in Clinical Practice, excluding procedures involving Material (Data, Documents, Records, or Specimens) that have been collected, or will be collected solely for non-research purposes (such as medical treatment or diagnosis)
	Category 5: Research involving materials that have been collected or will be collected solely for non-research purposes.
	Category 6: Collection of Data from Voice, Video, Digital, or Image Recordings Made for Research Purposes

X	**Category 7:** Research on Individual or Group Characteristics or Behavior or Research Employing Survey, Interview Oral History, Focus Group, Program Evaluation, Human Factors, Evaluation, or Quality Assurance Methodologies
	Category 8: Continuing review of research previously approved by the convened IRB
	Category 9: Continuing review of research, not conducted under an investigational new drug application or investigational device exemption where categories 2-8 do not apply but the IRB has determined and documented at a convened meeting that the research involves no greater than minimal risk and no additional risks have been identified.

Editorial Notes:

1. Approved

As a reminder, it is the responsibility of the P.I. and/or faculty sponsor to inform the IRB in a timely manner:

- when the project is completed,
- if the project is to be continued beyond the approved end date,
- if the project is to be modified,
- if the project encounters problems, or
- if the project is discontinued.

Any of the above notifications must be addressed in writing and submitted electronically to the IRB (http://www.bsu.edu/irb). Please reference the IRB protocol number given above in any communication to the IRB regarding this project. Be sure to allow sufficient time for review and approval of requests for modification or continuation. If you have questions, please contact Sandra Currie at (765) 285-5052 or slcurrie@bsu.edu.

In the case of an adverse event and/or unanticipated problem, you will need to submit written documentation of the event to IRBNet under this protocol number and you will need to directly notify the Office of Research Integrity (http://www.bsu.edu/irb) **within 5 business days**. If you have questions, please contact (ORI Staff).

Please note that all research records must be retained for a minimum of three years after the completion of the project or as required under Federal and/or State regulations (ex. HIPAA, FERPA, etc.). Additional requirements may apply.

Bryan Byers, PhD/Chair
Institutional Review Board

Christopher Mangelli, JD, MS, MEd, CIP/Director
Office of Research Integrity

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INFORMED CONSENT

Study Title **Assessing the Validity of the Industry Standard for Flexibility Assessment**

Study Purpose and Rationale
The purpose of this study is to assess the industry standard for flexibility, the sit and reach test, against the Functional Movement Screening. This study will give a better understanding of flexibility as an overall heath assessment and suggest a different approach to the industry standard.

Inclusion/Exclusion Criteria
You must be a Ball State University student between 18 and 25 years of age. You will not be allowed to participate if you have a diagnosed back or lower extremity injury.

Participation Procedures and Duration
You will be required to visit open lab times in Ball State Universities Human Performance Building. You will come in for approximately one, one-hour session. No other session is needed. This hour will include data collection such as informed consent, PAR-Q, Health History Questionnaire (HHQ), functional movement screening (FMS), and the sit and reach. First, you will be given the informed consent and media permission form. After giving consent you will then be required to fill out the PAR-Q and HHQ. Next, you will perform the sit and reach assessment. You will be given three attempts to assess if you can reach your toes or how far past your toes you can reach. Then, you will be informed of the FMS. You will be asked to complete four of the seven assessment tests. The Deep Squat, Hurdle Step, In-line Lunge, and Active Straight-Leg Raise will all be scored on a 1 to 3 scale. During the deep squat you will be asked to hold a dowel rod directly overhead, to keep your hands and arms in place, and to squat as low as you can with good form. The Hurdle Step requires you to step over a hurdle, that is a little below knee height with one leg, while holding a dowel across your shoulders. The heel of your bent knee must touch the ground on the other side of the hurdle and return to starting position. You will repeat this on the opposite leg. Next, the in-line lunge will be performed. Standing with your feet positioned one in front of the other, the same distance apart as the distance between the floor and your tibial tuberosity (directly below your knee cap), you will lunge down while holding a dowel behind your back. One hand will be positioned behind your lower back and the other holding near your neck to place the dowel vertically. You will be instructed to touch the back knee to the floor and return to standing position. This will be repeated again on the opposite leg. Finally, you will perform the active straight-leg raise. While lying on your back you will place your arms at your sides and raise one leg as high as you can without bending your knee and leaving the other leg on the floor. You will be asked to repeat with the opposite leg. I will videotape the FMS and mark the sit and reach with the best out of three trials. Video will be used for accurate scoring and will be deleted at the end of the project.

Audio or Video Tapes
Videotaping will be used for scoring and analyzing results. Film is intended for accurate scoring of the FMS and will be deleted from the camera after project completion (May 8th 2016).

Data Confidentiality or Anonymity
All data will be maintained as confidential and no identifying information such as names will appear in any publication or presentation of the data.

Storage of Data and Data Retention Period
The principal investigator (PI) will keep data until the end of the semester on May 8th 2016. No one will have access to this material other than the PI and faculty advisor. Final data will data will be stored in locked file cabinet in my Adviser's office. No identifiers will appear in final data.

Risks or Discomforts
Risks in this study include a potential of falling from on leg instability and/or muscle soreness after testing.

Who to Contact Should You Experience Any Negative Effects from Participating in this Study
If you should at any time need medical services contact the Ball State Health Center by visiting 1500 Neely Avenue Muncie, Indiana 47306 or calling 765-285-8431.

Benefits
The results obtained from the flexibility and movement assessment may assist in the awareness of your flexibility level.

Voluntary Participation

Your participation in this study is completely voluntary and you are free to withdraw your permission at anytime for any reason without penalty or prejudice from the investigator. Please feel free to ask any questions of the investigator before signing this form and at any time during the study.

IRB Contact Information
For one's rights as a research subject, you may contact the following: For questions about your rights as a research subject, please contact the Director, Office of Research Integrity, Ball State University, Muncie, IN 47306, (765) 285-5070 or at irb@bsu.edu.

Study Title **Assessing the Validity of the Industry Standard for Flexibility Assessment**

****

Consent
I, _____, agree to participate in this research project entitled, **Assessing the Validity of the Industry Standard for Flexibility Assessment.** I have had the study explained to me and my questions have been answered to my satisfaction. I have read the description of this project and give my consent to participate. I understand that I will receive a copy of this informed consent form to keep for future reference.

To the best of my knowledge, I meet the inclusion/exclusion criteria for participation (described on the previous page) in this study.

_____ _____

Participant's Signature Date

Researcher Contact Information

Principal Investigator:

Michaela Hull, Honors College Student
School of Kinesiology
Ball State University
Muncie, IN 47306
Telephone: (812) 322-3338
Email: mehull@bsu.edu

Faculty Supervisor:-

Mary Winfrey-Kovell
School of Kinesiology
Ball State University
Muncie, IN 47306
Telephone: (765) 285-1749
Email: mlwinfreykov@bsu.edu

BALL STATE UNIVERSITY

Media Permission for Research Uses

Title of Study: Assessing the Validity of the Industry Standard for Flexibility Assessment

Principal Investigator: Michaela Hull

I have had an opportunity to read, review and ask questions about the above-named research project as part of the informed consent process. I understand that part of the research involves the use of various types of media (for example, audio recordings, videotaping, digital pictures, etc.). The following information was described to me by the researcher and in the informed consent form:

- The type or types of media to be used;
- How this media was to be used in the research project;
- Who would have access to it;
- What safeguards were to be used;
- What privacy and security precautions would be used (if applicable);
- How the media would be destroyed and when once the research was completed (if applicable);
- That I have the right to withdraw from the study at any time; and
- That I can receive a copy of both the informed consent form and this media release form for my records.

As such, I agree to allow the researcher to use the media described to me as part of the above named research project. This media will **be used only for the above-named project**, *unless* I give the researcher written permission (see page 2) for other possible uses.

For questions about your rights as a research subject, please contact the Director, Office of Research Integrity, Ball State University, Muncie, IN 47306, (765) 285-5070 or at irb@bsu.edu.

_____ _____

Date *Signature*

_____

Printed Name

Physical Activity Readiness Questionnaire - PAR-Q (revised 2002)

PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO		
☐	☐	1.	**Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?**
☐	☐	2.	**Do you feel pain in your chest when you do physical activity?**
☐	☐	3.	**In the past month, have you had chest pain when you were not doing physical activity?**
☐	☐	4.	**Do you lose your balance because of dizziness or do you ever lose consciousness?**
☐	☐	5.	**Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?**
☐	☐	6.	**Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?**
☐	☐	7.	**Do you know of any other reason why you should not do physical activity?**

If you answered

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

→ **DELAY BECOMING MUCH MORE ACTIVE:**

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME _____

SIGNATURE _____ DATE _____

SIGNATURE OF PARENT or GUARDIAN (for participants under the age of majority) _____ WITNESS _____

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

Supported by: Health Canada Santé Canada

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MEDICAL HISTORY QUESTIONNAIRE

This is your medical history form, to be completed prior to participation in this study. All information will be kept confidential. This information will be used for the evaluation of your health and readiness to begin this study. The form is extensive, but please try to make it as accurate and complete as possible. Please take your time and complete it carefully and thoroughly, and then review it to be certain you have not left anything out. Your answers will help us design a comprehensive program that meets your individual needs.

If you have questions or concerns, we will help you with those after this form is completed. We realize that some parts of the form will be unclear to you. Do your best to complete the form. Your questions will be thoroughly addressed afterwards. It might be helpful for you to keep a written list of questions or concerns as you complete the medical history form.

Name: _____

Date: _____

MEDICAL HISTORY AND SCREENING FORM

General Information

Participant:

Name _____

Birth date _____

Sex:

☐ Male ☐ Female

Present Medical History

Check those questions to which you answer yes (leave the others blank).

- ☐ Has a doctor ever said your blood pressure was too high?
- ☐ Do you ever have pain in your chest or heart?
- ☐ Are you often bothered by a thumping of the heart?
- ☐ Does your heart often race?
- ☐ Do you ever notice extra heartbeats or skipped beats?
- ☐ Are your ankles often badly swollen?
- ☐ Do cold hands or feet trouble you even in hot weather?
- ☐ Has a doctor ever said that you have or have had heart trouble, an abnormal electrocardiogram (ECG or EKG), heart attack or coronary?
- ☐ Do you suffer from frequent cramps in your legs?
- ☐ Do you often have difficulty breathing?
- ☐ Do you get out of breath long before anyone else?
- ☐ Do you sometimes get out of breath when sitting still or sleeping?
- ☐ Has a doctor ever told you your cholesterol level was high?
- ☐ **Has a doctor ever told you that you have an abdominal aortic aneurysm?**
- ☐ **Has a doctor ever told you that you have critical aortic stenosis?**

Comments: _____

_____

_____

_____

Do you now have or have you recently experienced:

- ☐ Chronic, recurrent or morning cough?
- ☐ Episode of coughing up blood?
- ☐ Increased anxiety or depression?
- ☐ Problems with recurrent fatigue, trouble sleeping or increased irritability?
- ☐ Migraine or recurrent headaches?
- ☐ Swollen or painful knees or ankles?

- ☐ Swollen, stiff or painful joints?
- ☐ Pain in your legs after walking short distances?
- ☐ Foot problems?
- ☐ Back problems?
- ☐ Stomach or intestinal problems, such as recurrent heartburn, ulcers, constipation or diarrhea?
- ☐ Significant vision or hearing problems?
- ☐ Recent change in a wart or a mole?
- ☐ Glaucoma or increased pressure in the eyes?
- ☐ Exposure to loud noises for long periods?
- ☐ An infection such as pneumonia accompanied by a fever?
- ☐ Significant unexplained weight loss?
- ☐ A fever, which can cause dehydration and rapid heart beat?
- ☐ A deep vein thrombosis (blood clot)?
- ☐ A hernia that is causing symptoms?
- ☐ Foot or ankle sores that won't heal?
- ☐ Persistent pain or problems walking after you have fallen?
- ☐ Eye conditions such as bleeding in the retina or detached retina?
- ☐ Cataract or lens transplant?
- ☐ Laser treatment or other eye surgery?

Comments: _____

_____

_____

_____

Men and women answer the following:

List any prescription medications you are now taking: _____

_____

_____

List any self-prescribed medications, dietary supplements, or vitamins you are now taking: _____

_____

_____

Date of last complete physical examination: _____

☐ Normal ☐ Abnormal ☐ Never ☐ Can't remember

List any other medical or diagnostic test you have had in the past two years: _____

_____

_____

List hospitalizations, including dates of and reasons for hospitalization: _____

_____

_____

Past Medical History

Check those questions to which your answer is yes (leave others blank).

- ☐ Heart attack if so, how many years ago? _____
- ☐ Rheumatic Fever
- ☐ Heart murmur
- ☐ Diseases of the arteries
- ☐ Varicose veins
- ☐ Arthritis of legs or arms
- ☐ Diabetes or abnormal blood-sugar tests
- ☐ Phlebitis (inflammation of a vein)
- ☐ Dizziness or fainting spells
- ☐ Epilepsy or seizures
- ☐ Stroke
- ☐ Diphtheria
- ☐ Scarlet Fever
- ☐ Infectious mononucleosis
- ☐ Nervous or emotional problems
- ☐ Anemia
- ☐ Thyroid problems
- ☐ Pneumonia
- ☐ Bronchitis
- ☐ Asthma
- ☐ Abnormal chest X-ray
- ☐ Other lung disease
- ☐ Injuries to back, arms, legs or joint
- ☐ Broken bones
- ☐ Jaundice or gall bladder problems

Comments: _____

_____

Diet/Exercise

What do you consider a good weight for yourself? _____

My current weight is: _____

One year ago my weight was: _____

How many days a week do you exercise? : _____

How long do you exercise during each session? : _____

What types of exercises to you do? : _____